


10/593112
[AP9/Rec'd PCT/PTO 18 SEP 2006]

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Established in Colombes on September, 12th, 2006


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SAS de 53 664 € - RC Nanterre 96 B 0358 - SIRET 775 669 906 00056 - APE 748F - N° TVA intracommunautaire FR 03 775 669 906

Junction elements built into the ends of a conveyor belt

Conveyor belts have been known for a long time, generally made from rubber or a synthetic material and comprising a flexible inner core.

5 Various methods have been used in the past to provide the junction between the ends of a conveyor belt that is initially open at both ends, with a view to transforming it into a so-called endless operational conveyor belt. These junction methods are also used for the insertion of new
10 sections in a current conveyor belt, with a view to extending the length of said current belt, for example to follow-up the progress of mining work or to replace a part of the conveyor belt that has been damaged.

15 Notable among these methods is the vulcanisation of the ends, with a prior operation of baring the core and forming degrees with shapes that complement the two ends of the conveyor belt. Vulcanisation provides excellent results, but it has the disadvantage of the time required to perform it, taking up to 24 hours, which is a definite handicap.

20 Another method used is gluing with technical glues. As with vulcanisation, it requires a great deal of care to be taken as regards the preparation of the ends, and great rigour as regards the conditions under which the technical glues are applied.

25 Metal clips mounted on the ends of the conveyor belt and connected to each other by means of a linking and hinging rod passing through the knuckles of the metal clips, mounted on the edge of the ends of the conveyor belt, are another well known method used for joining the ends of conveyor
30 belts. However, this device has problems caused by the wear of the clips and of the linking rods as well as by localised wrenching, which require repairs and increased stopping times of the conveyor belts.

35 New types of junctions have furthermore been suggested by the applicant of the present application. These junctions

are described in detail, for example, in United States of America patents no. 583 957 and 6 601 698. Express reference is made to these patents. In short, these junctions consist of reinforced junction elements made from rubber or synthetic materials, with a general H shape, extending around the ends of the conveyor belt, on either side of the central section of the generally H-shaped junction, one of the flanges having pre-punched holes equipped with cup inserts, and the other flange having pre-punched holes equipped with bush inserts. These holes equipped with cups are placed in staggered rows over quite a large surface in order best to distribute the traction efforts to which the flanges of the junction and the conveyor belt are subjected.

These H-shaped junctions, screwed in the perpendicular direction of the general plane of the junctions, described in United States of America patent no. 6 601 698 B2, have turned out to be excellent as far as their strength is concerned.

In addition, it is possible to remove screwed junctions of this type, which allows easy replacement of a damaged section of the conveyor belt, or to extend the length of the conveyor belt with a view to following up the progress of mining work, for example.

However, these junctions, which have solved many problems in certain industries, in particular in heavy extraction industries, for transporting coal, minerals, phosphates and other heavy loose products, still encounter, in certain cases, problems with wrenching of the flanges which, although they are bevelled in the direction of the thickness at the end that is in contact with the conveyor belt, have a thickness that sometimes catches with the scrapers with which these belts are equipped.

Finally, it is desirable to have, for example in order to replace conveyor belts of a given machine of standard model and length, for example in roadworks, earthworks, farming

work and similar work, conveyor belts with ends that are prepared for being quickly and easily connected.

5 Past patent applications have already proposed conveyor belts equipped at their ends with half-junctions with matching shapes. The patents of the prior art GB-A-548 209 by the Dunlop Rubber Company Limited, GB-A-708 461 by Cable Belt Limited and FR-A-1 140 516 by the Dunlop Rubber Company Limited can be mentioned as an example of this.

10 However, the junction devices provided in these patents of the prior art were difficult to implement and the handling of the ends of the conveyor belt in order to present them for mutual attachment was very complex. Moreover, the attachment means, slats or rods passing through the transverse holes alternately belonging to either one of the
15 ends of the conveyor belt were very difficult to install, in particular in the heavy conveyor belts. Finally, the resistance to traction of these junctions with transverse slats was not satisfactory. Indeed, the transverse slats or rods caused shearing effects in the constituent material,
20 present between the two layers of core placed respectively above and under the transverse holes, which resulted in wear and tear of the junctions.

The problem thus posed is resolved according to the invention by means of a junction for a conveyor belt,
25 consisting of two half-junctions, made from vulcanised rubber or a plastic material, each solidly attached respectively to one end of the conveyor belt, the half-junctions having a generally flat shape and a maximum thickness that is equal to or slightly less than that of the
30 end of the conveyor belt with which it is solidly attached and having matching shapes that allow them to be interlinked such as to form a junction with a thickness that is at most equal to that of the ends of the conveyor belt, said two half-junctions comprising a flexible core, textile or
35 otherwise, and being respectively equipped with cup inserts and bush inserts allowing the passage of assembly means, of

the rod type, arranged perpendicularly to the general plane of the junction,

characterised in that

5 - the solid attachment of each of the two half-junctions with the corresponding conveyor belt end is provided, on the one hand, by means of the continuity of the constituent material of the end and of the half-junction and, on the other hand, by flexible cores, textile or otherwise, of the corresponding ends of the conveyor belt, each of the cores
10 extending towards the inside of each half-junction forming a fold of the side of the free edge, or front edge of each of the half-junctions, next to said free edge, the core sections thus folded extending at least beyond the bush insert that is furthest from the section of the front edge
15 that is longitudinally in line with said bush insert, the male half-junctions comprising two levels, a top level and a bottom level, the top level containing the folded core and the bottom level only comprising the constituent material, in which the front edge has substantially the same shape as
20 the front edge of the top level, but is shifted towards the rear at least by the distance that separates the front edge from the cup inserts that are the furthest from the front edge, and the female half-junctions comprising two levels, a top level that only comprises the constituent material and
25 in which the shape of the front edge matches that of the front edge of the matching male half-junctions, and a bottom level containing the folded core and the bush inserts, in which the front edge is shifted towards the front in relation to the front edge of the top level, its shape
30 matching that of the front edge of the male half-junction,

 - the solid attachment of the male and female half-junctions with each other is provided by rod fasteners, such as rivets or studs, but preferably by means of screws, in which the head rests against the bottom of the cup inserts and in
35 which the thread is screwed into the relevant bush inserts, which are threaded on the inside or smooth in the case that self-tapping screws are used, with neither the heads of the

screws nor their opposite ends sticking out beyond the outside surfaces of the half-junctions at the points where the screws are inserted.

5 The following description conventions have been adopted for the description of the present invention, but it is evident that it would also have been possible to use the opposite conventions, for example top and front replacing bottom and rear, according to the position of observation in relation to the objects described or the presentation of the objects
10 described in relation to the observer. This is why the description conventions are mentioned here. In the present description and in the appended claims, front refers to the free side of each of the half-junctions, rear meaning the side connected to the relevant end of the conveyor belt, top
15 level means the level that is next to the part of the conveyor belt which receives the material or objects to be transported, bottom level means the level that is next to the part of the conveyor belt that is in contact with the driving rollers and the idler rollers. Male applies to the half-junctions that comprise cup inserts and female applies
20 to the half-junctions that comprise bush inserts. Longitudinal refers to the longitudinal direction of the conveyor belt, transverse refers to the direction that is perpendicular to the longitudinal direction of the conveyor belt to which the half-junctions are connected or will be
25 connected, regardless of the relative dimensions of the half-junction sections to which these adjectives are applied.

It should be noted that, through application of the
30 preceding, while in all the examples shown below in the drawings, the screws and the cup inserts of the male half-junction are located opposite the conveyor belt, it is also possible to set them up the other way round, the male section (and therefore its screws and cup inserts) being
35 located on the side of the conveyor belt.

It should be noted that the term "end of conveyor belt" used in the present description does not necessarily refer to the

end of a conveyor belt that already exists when the half-junctions are in the manufacturing stage. It can refer, as shown below, to the "end of conveyor belt" comprising all the elements of a conveyor belt (constituent material surrounding a flexible core on either side thereof and solidly attached thereto by means, for example, of vulcanisation) but that is very short, which is designed for being connected, for example by vulcanisation, according to well known methods, to a conveyor belt with a length chosen during a later manufacturing stage, or even on the premises of the user, with a view to preparing a replacement of a conveyor belt, or an extension of a conveyor belt while it is still in service, its effective assembly on a conveyor device therefore being possible in a very short period of time compared with vulcanisation carried out on a conveyor belt that needs to be stopped. Evidently, in many cases, for example in cases in which the conveyor belt is of standard length (machines for rolling hay or straw, roadwork machines, etc.), the "end of the conveyor belt" on which the half-junction according to the invention is installed according to the invention is that of a very long band and not that of a very short section as mentioned above. In many cases, the moulding of the half-junction is carried out at the same time as the moulding of the actual conveyor belt, the constituent materials and the core being the same in the conveyor belt and in the half-junctions installed on either one of the ends thereof.

According to an advantageous improvement of the invention which provides increased strength to the half-junctions, the junction is characterised in that the bush inserts are made in the female half-junctions so that the bush drives the edges of the hole of the two sections of the core that surround the bush perpendicularly in the general plane of these layers and are therefore solidly attached to the female half-junction in two perpendicular planes by the constituent material and the sections of the core that surround them.

According to a further development, the junction is characterised in that the bush inserts comprise a section forming a flat flange that is solidly attached to the actual bush section and is arranged perpendicularly to the end of the bush that is the closest to the outside surface of the bottom level of the matching female half-junction, and is only separated from this surface by a thin layer of the constituent material, these flanges extending in a plane that is parallel to the general plane of the half-junction and being solidly attached to the constituent material that surrounds them.

As regards the cup inserts, it is advantageous that the cup inserts are made in the male half-junctions so that the cup rests closely, by its sections that border the central hole, against the edges of the hole made in two sections of the core, with which it is solidly attached by the surrounding constituent material.

Several shapes of the front edges of the top and bottom levels of the male and female half-junctions are possible without departing from the context of the invention. Among these shapes are junctions in which the front edge of the top level of the male half-junction consists of a succession of front edge sections perpendicular to the longitudinal direction of the male half-junction, separated from each other in the longitudinal direction and front edge sections that extend longitudinally, each of these front edge sections perpendicular to the longitudinal direction being connected to the closest front edge section or sections that is/are perpendicular to the longitudinal direction shifted towards the rear by front edge sections that are parallel to the longitudinal direction, thus forming a broken line, the shapes of the front edge of the bottom level of the male half-junction, of the front edge of the top level of the female half-junction and of the front edge of the bottom level of the female half-junction resulting, as defined above, from the shape of the front edge of the top level of the male half-junction, the core being slit longitudinally

over the distances required to form shifted folds and the shifted folded sections corresponding to the shifted front edge sections. We can also mention the junctions in which the front edge is presented in the form of broken lines organised according to different modes explained below in relation with embodiments indicated by way of example, the general aim being not to present the front edges that extend over considerable distance to the scrapers, since said edges could catch with the scrapers, which is contrary to one of the main aims of this invention. A negative example such as this will be provided below in relation to the explanations regarding one drawing of such an example.

Better still, front edges that only have oblique lines in relation to the longitudinal direction are at even less risk of catching with the scrapers. Examples of this will be seen in the embodiments of the invention described below.

As shown in other examples, the applicant has also studied the front edge shapes in which it is quite straightforward to form folds of the core, while striving to achieve a shape that will not catch with the scrapers.

On this subject, it should be remembered, bearing in mind that, as mentioned above, one aim of the invention is for the thickness of the interlinked and assembled half-junctions not to exceed the thickness of the associated conveyor belt ends, that in theory the scrapers should not catch with the front edges of the half-junctions. However, minimal movements of the top levels of the half-junctions are possible during operation, which is why the choice of shapes such as those studied by the applicant is important to prevent giving the scrapers a hold, small as it may be.

Particularly advantageous embodiments of the invention are presented in the drawings, in which:

figure 1 shows a perspective view of an embodiment of a junction according to the invention of the ends of a conveyor belt, in place on a driving roller,

figure 2 shows a perspective view of another embodiment of a junction according to the invention and of the ends of a conveyor belt, in place on a driving roller,

5 figure 3 shows, in a perspective view, sections of the core folded with a view to being included in the half-junctions with matching shapes according to the invention,

figure 4 shows, in a longitudinal section view and in a diagrammatic fashion, the elements that make up two half-junctions according to the invention,

10 figure 5 shows, in a longitudinal section view and in a diagrammatic fashion, the elements that make up two half-junctions according to the invention, in different stages of insertion (figure 5a) of the elements and of assembly of the two half-junctions (figure 5b),

15 figure 6 shows, in an outline sketch, one embodiment of the junction according to the invention in the assembled stage, in which the shape matches that of the folded cores of figure 3,

20 figure 7 shows, in a perspective view, the embodiment of the invention shown in figure 6, with the two half-junctions still separated,

figures 8 and 9 show folded core sections corresponding to other embodiments of the half-junctions according to the invention,

25 figure 10 is a perspective view of yet another embodiment of the junction according to the invention,

figure 11 is a perspective view of cores folded and indented with a view to be added to a junction according to figure 10,

30 figure 12 is a perspective view of yet another embodiment of a junction according to the invention,

figure 13 is a perspective view of cores folded with the aim of being added to a junction according to claim 12,

figure 14 shows an outline sketch of the junction according to figure 10,

5 figure 15 shows an outline sketch of the junction according to figure 12,

figure 16 shows, in an enlarged longitudinal section view, the screw-cup-insert-bush-insert assembly system and the insertion of a cup insert and a bush insert in the
10 respective ends of a conveyor belt.

In figure 1, a roller 5 is used for driving the ends 1, 1' of the conveyor belt, notably comprising a male half-junction 3 and a female half-junction 4 assembled by means of screws 15. This junction only shows the general principle
15 of the junctions according to the invention since, as already mentioned above, it has a front section of the male half-junction 3 which extends across the entire width and which can therefore catch easily with the scrapers.

Figure 2 shows another more elaborate junction according to the invention, in the same position as the junction in
20 figure 1. It is remarkable that the front edge of the male half-junction 3 has sections that are shifted in the longitudinal direction, which make it possible to prevent any possible catching of the scrapers over too considerable
25 a section of the width at the same time.

Figure 3 shows a perspective view of the folded sections of the core 7, which are folded over the cores 6 level with the longitudinally shifted folds 8 coming from the ends of the conveyor belt (not shown), the cores being slit
30 longitudinally to allow said shifting.

Figure 4 shows, in a diagrammatic longitudinal section view, the elements of the half-junctions: the cup inserts 13, the top layer of constituent material 10, the folded cores 6, 7, the folds 8, the bottom layers of constituent material 11, a

thin intermediate layer 12 between the folded cores 6, 7 of the two half-junctions, the bush inserts 14, their bushes 14", their flanges 14', the screws 15 used for assembly being shown inside the cup inserts 13.

5 Figures 5a and 5b show the same elements, with the same numerical references, the cup inserts and the bush inserts being held inside the vulcanised layers of the vulcanised material and the core, the half-junctions being ready for assembly in figure 5a and assembled in figure 5b.

10 In figure 6, which shows an outline sketch of an assembled junction, the top surface of the male half-junction 3 is shown, as are the screws 15 and the cup inserts 13.

Figure 7, which shows a perspective view of one embodiment, remarkably shows front edge sections 16pp that are
15 perpendicular to the longitudinal direction of the male half-junction 3, front edge sections 16pl that are parallel to the longitudinal direction of the male half-junction 3, a top level 22 of the male half-junction 3, a bottom level 23 of the male half-junction as well as the side of the female
20 half-junction 4 with a shape that matches that of the male half-junction 3, the top 20 and bottom 21 levels of the female half-junction and, finally, the connecting ends 1, 1'.

Figures 8 and 9 show two other ways of folding the cores,
25 which respectively correspond to two other shapes of the front edge that are related to that shown in figure 3.

Figure 10 shows a perspective view of another embodiment of the invention.

Figure 11 shows the folded cores, which correspond to the
30 embodiment of the invention shown in figure 10. In this embodiment, shown completed and assembled in figure 10, the front edge 16 of the top level 22 of the male half-junction 3 is overall perpendicular to the longitudinal direction, with the exception of two V-shaped indentations 19, 19' made
35 so that the point of the V is pointing towards the rear. A

matching shape can be seen in figure 11, the core being folded and indented according to a shape identical to that of the completed front edge and being located to the rear in the completed male half-junction. The drawing only shows two V-shaped indentations but, depending on the width of the end of the conveyor belt, it is obviously possible to provide only one or more than two V-shaped points. The edge of the top level of the female half-junction, the constituent material of which is a continuation of that of the end of the corresponding conveyor belt, has a shape that matches that of the front edge of the top level of the male half-junction 3.

The perforations appearing at both the front edge of the bottom level of the female half-junction 4 and the front edge of the bottom level of the male half-junction 3 are notable. Likewise, the edge of the bottom section of the male half-junction in which the constituent material is a continuation of that of the end of the matching conveyor belt has a shape that matches that of the front edge of the female half-junction. The assembly screws 15 are placed, as are the cup inserts and the bush inserts, over a distance that can be increased according to the particular shape of this embodiment of the invention, which means that a larger number of screws can be placed in both the longitudinal and transversal directions, increasing the dimensions of the male and female half-junctions in the longitudinal direction.

Figure 12 shows yet another embodiment of the invention.

Figure 13 shows the folded cores that correspond to the embodiment of the invention shown in figure 12.

The front edge of the top level 22 of the male half-junction is notably seen in the shape of a V in an outline sketch, with the point of the V pointing towards the front, the shapes of the front edges of the bottom level 23 of the male half-junctions 3 in which the constituent material is a continuation of that of the corresponding half end, and of

the top level 20 of the female half-junction 4 in which the constituent material is a continuation of that of the corresponding half end, resulting from the shape of the front edge of the top level 22 of the male half-junction 3 as defined previously.

Figure 14 shows the screws 15, the cup inserts 13 and the indentations 19, 19' of the junction of figure 10, in an outline sketch.

Figure 15 shows the cup inserts 13 and the V shape of the top level 22 of the male half-junction of figure 12, in an outline sketch.

Finally, figure 16, which is an enlarged view of a longitudinal section view of the screw-cup-insert-bush-insert assembly system, shows the screw 15, the cup insert 13, the top level 22 of the male half-junction, the top level 20 of the female half-junction, the bottom level 21 of the female half-junction, the bush insert 14, its bush 14" and its flange 14'. Notably, each half-junction also shows the top folded layers and the bottom layers, said layers being lifted along the bush and lowered along the cup.

The present invention is described with the help of several embodiments acting as examples; it is not, however, limited to the examples shown and described. Its scope extends to the contents of the claims, supported by the complete text of the description section.